

While this type of system functions very well as a core biopsy device, there are occasions when it may be useful to have the capability of acquiring a relatively large intact tissue sample. One such core biopsy device is disclosed in U.S. Patent No. 5,111,928, to Kornberg et al, also expressly incorporated in its entirety by reference herein. In the device disclosed by Kornberg et al., a tissue receiving port is disposed at the distal end of the device and is oriented longitudinally. A disadvantage of this type of device, however, is the inability to acquire a tissue sample having a cross-section larger than that of the cannula through which the sample will be removed. Additionally, it is difficult, using such a device, which obtains cylindrical shaped specimens, to determine whether an entire lesion of interest is being removed or whether a further procedure will be necessary. This is particularly true because most lesions of interest are typically spherical in shape, having a diameter of approximately 1 cm. The only way one can tell whether the entire lesion has been removed using the Kornberg technique is to remove and examine the specimen, determine whether each of the margins of the specimen is "clean," meaning that there is no evidence of lesion, or "dirty," meaning that lesion tissue is evident right to the edge of the specimen. Of course, if one or more specimen margins is "dirty," it is almost a certainty that a portion of the lesion remains in the patient, and if the biopsy test results on the lesion are positive, a further surgical procedure will be indicated.

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U.S. Patent Application Serial No. 09/057,303, priority to which is claimed herein, discloses apparatuses and methods for precisely isolating a target lesion, resulting in a high likelihood of "clean" margins about the lesion. This advantageously will often result in the ability to both diagnose and treat a malignant lesion with only a single percutaneous procedure, with no followup percutaneous or surgical procedure required, while minimizing the risk of migration of possibly cancerous cells from the lesion to surrounding tissue or the bloodstream. Various tissue acquisition instrument embodiments are disclosed for segmenting the target tissue, including embodiments wherein the instrument comprises a cutting element

which is extendable radially outwardly and movable circumferentially to define a peripheral margin about a tissue sample, and other embodiments wherein the cutting element is extendable radially outwardly and movable axially to define peripheral margins about the tissue sample.

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### SUMMARY OF THE INVENTION

According to a first exemplary embodiment of the present invention, a tissue acquisition device useful in retrieving tissue samples from a patient comprises an inner cannula having a proximal end, a distal end, and a longitudinal axis extending between said proximal and distal ends, said inner cannula including a tubular sidewall, a main lumen extending along said longitudinal axis from said proximal end toward said distal end, a small lumen extending longitudinally through said sidewall from said proximal end toward said distal end, and a cutout in said sidewall distal of said small lumen; an outer cannula having a proximal end, a distal end, and a longitudinal axis extending between said proximal and distal ends, said outer cannula including a tubular sidewall, a main lumen extending along said longitudinal axis from said proximal end toward said distal end, and a cutout in said sidewall; a cutting wire positioned in said small lumen, said cutting wire having a proximal end and a distal end and being rotatable and longitudinally extendable in said small lumen, said cutting wire including a cutting loop at a said distal end which extends out of said small lumen; wherein said inner cannula is positioned in said outer cannula main lumen with said inner cannula cutout positioned at the same longitudinal position as said outer cannula cutout.

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According to a second exemplary embodiment of the present invention, a system for sampling tissue from a patient comprises a radio frequency (RF) energy generator capable of generating RF energy, and a tissue acquisition device as

described above, said cutting wire of said tissue acquisition device in electrical communication with said RF energy generator.

According to a third exemplary embodiment of the present invention, a method of sampling tissue from a patient comprises the steps: inserting a cannula into tissue of a patient, said cannula including a pair of concentric cannulae each having a cutout therein, said cannula including a RF energy cutting loop in said cannula; cutting said tissue along a plane by moving said RF energy cutting loop from a position inside said cannula to a position outside said cannula while applying RF energy to said RF energy cutting loop; cutting said tissue by moving said RF energy cutting loop along a first path extending partially along the length of said cannula while applying RF energy to said RF energy cutting loop; and cutting said tissue along a plane perpendicular to said path by moving said RF energy cutting loop.

According to a fourth exemplary embodiment of the present invention, a tissue acquisition device useful in retrieving tissue samples from a patient comprises a generally cylindrical cannula having a longitudinal axis and a cutout, an electrically energized cutting wire loop arranged generally in a plane substantially parallel to said cannula longitudinal axis, said loop being rotatable about a loop axis which extends generally parallel to said cannula longitudinal axis, said loop axis being offset from said cannula longitudinal axis, whereby, upon rotation of said loop about said loop axis, said loop moves from a location within said cannula to a location extending through said cutout.

Still other objects, features, and attendant advantages of the present invention will become apparent to those skilled in the art from a reading of the following detailed description of embodiments constructed in accordance therewith, taken in conjunction with the accompanying drawings.